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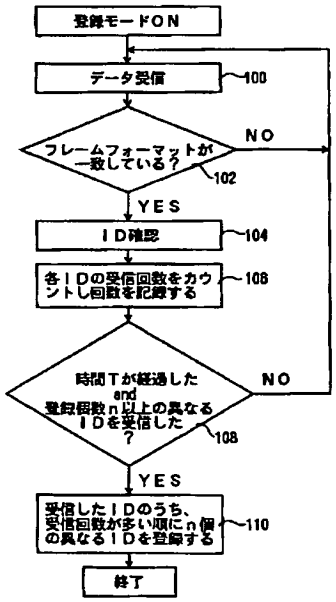
(54)【発明の名称】　タイヤ空気圧警報装置

(57)【要約】
【課題】本発明は、自車両に取り付けられたタイヤのタイヤ識別符号のみが確実に登録されるタイヤ空気圧警報装置を提供することを目的とする。
【解決手段】各タイヤが備えるセンサユニット１０からは、タイヤ空気圧情報及びタイヤ識別符号ＩＤが送信される。監視ユニット１２が備える受信ＣＰＵ２８は、受信したタイヤ識別符号ＩＤを予め不揮発性メモリ３０に登録されたタイヤ識別符号ＩＤと比較して、信号を送信したタイヤを特定する。不揮発性メモリ３０にタイヤ識別符号ＩＤを登録する際、受信ＣＰＵ２８は、所定時間Ｔの間に受信したタイヤ識別符号ＩＤのうち、受信頻度が高い方からｎ個のタイヤ識別符号ＩＤを登録する。



1

【特許請求の範囲】

【請求項１】タイヤの空気圧を検出し、検出したタイヤ空気圧をタイヤ識別符号と共に送信する送信部と、

前記タイヤ空気圧及び前記タイヤ識別符号を受信し、該タイヤ識別符号を所定個数の登録識別符号と比較してタイヤを特定すると共に、タイヤ空気圧が所定値以下の場合に警報を発する受信部とを備えるタイヤ空気圧警報装置であって、

前記受信部は、登録モードにおいて、所定時間内に受信したタイヤ識別符号のうち、受信頻度の高い方から前記所定個数のタイヤ識別符号を前記登録識別符号として記憶することを特徴とするタイヤ空気圧警報装置。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、タイヤ空気圧警報装置に係り、特に、各タイヤに内蔵されたタイヤの空気圧に関する情報を送信する送信部と、送信部から送信されるタイヤの空気圧に関する情報を受信する受信部とを備えるタイヤ空気圧警報装置に関する。

【０００２】

【従来の技術】従来より、タイヤの空気圧の測定値を含む無線信号に基づいてタイヤの空気圧が異常値であるか否かを判断し、異常値である場合に警報を発するタイヤ空気圧警報装置が広く知られている。このようなタイヤ空気圧警報装置は、各タイヤ内に設けられた送信部と、送信部から送信された無線信号を受信する受信部とを備えている。

【０００３】送信部はタイヤの空気圧を測定し、その測定値とタイヤを識別するためのタイヤ識別符号ＩＤとを無線送信する。受信部は送信部から送信された無線信号を受信し、タイヤ空気圧の異常発生の有無を判定する。受信部が有するメモリには、車両が備える全てのタイヤのタイヤ識別符号ＩＤが予め登録されている。受信部は、受信した無線信号に含まれるタイヤ識別符号ＩＤとメモリに登録されたタイヤ識別符号ＩＤを比較して、受信した無線信号に含まれるタイヤ空気圧情報がどのタイヤのものであるかを特定する。タイヤ識別符号ＩＤは、タイヤを車両に取り付ける際にメモリに登録される。例えば、特開平９－２１０８２７号に記載されるタイヤ空気圧警報装置では、受信部は、最初に受信した４つのタイヤ識別符号ＩＤを自車両のタイヤ内に設けられた送信部からのタイヤ識別符号ＩＤとして登録する。

【０００４】

【発明が解決しようとする課題】受信部は、他の車両に取り付けられたタイヤが備える送信部からの無線信号等を受信する場合がある。特に、車両生産工場等、多くの車両が密集する場所では、受信部が他の車両に取り付けられたタイヤに関する無線信号を受信してしまう可能性が高い。

【０００５】従って、上記従来例のように、最初に受信

2

した４つのタイヤ識別符号ＩＤをメモリに登録する構成では、他の車両のタイヤに関するタイヤ識別符号ＩＤが誤登録される可能性がある。本発明は、上記点に鑑みてなされたものであり、自車両に取り付けられたタイヤのタイヤ識別符号ＩＤのみが確実に登録されるタイヤ空気圧警報装置を提供することを目的とする。

【０００６】

【課題を解決するための手段】上記目的は、タイヤの空気圧を検出し、検出したタイヤ空気圧をタイヤ識別符号と共に送信する送信部と、前記タイヤ空気圧及び前記タイヤ識別符号を受信し、該タイヤ識別符号を所定個数の登録識別符号と比較してタイヤを特定すると共に、タイヤ空気圧が所定値以下の場合に警報を発する受信部とを備えるタイヤ空気圧警報装置であって、前記受信部は、登録モードにおいて、所定時間内に受信したタイヤ識別符号のうち、受信頻度の高い方から前記所定個数のタイヤ識別符号を前記登録識別符号として記憶するタイヤ空気圧警報装置によって達成される。

【０００７】受信部にとって、同一の車両に取り付けられた送信部が最も近くに設けられたタイヤ識別符号の送信機である。このため、所定時間内に受信部が受信するタイヤ識別符号は、同一の車両に取り付けられた送信部からのものが最も多くなる。従って、本発明のように、登録モード時に、所定時間内に受信されたタイヤ識別符号のうち受信頻度の高い方から所定個数のタイヤ識別符号が受信部により登録識別符号として記憶される構成とすることで、自車両に取り付けられたタイヤに関するタイヤ識別信号のみが確実に記憶される。

【０００８】

【発明の実施の形態】図１は、本発明の一実施例であるタイヤ空気圧警報装置のシステム構成図である。図１に示すタイヤ空気圧警報装置は、タイヤの空気圧を監視し、タイヤ空気圧が予め設定された設定空気圧から所定値以上低下した場合にタイヤ空気圧の異常を知らせる警報を発する装置である。

【０００９】図１に示すように、本実施例のタイヤ空気圧警報装置は、センサユニット１０及び監視ユニット１２を備えている。センサユニット１０は、車輪ホイールの内部に取り付けられており、内蔵電池１４を電源として駆動される。センサユニット１０は、タイヤ空気圧センサ１６、送信ＣＰＵ１８、不揮発性メモリ２０及び送信回路２２を備えている。また、センサユニット１０には、送信アンテナ２４が取り付けられている。

【００１０】タイヤ空気圧センサ１６は、タイヤの空気圧に応じた信号を出力するセンサである。タイヤ空気圧センサ１６の出力信号は、送信ＣＰＵ１８に供給される。送信ＣＰＵ１８は、タイヤ空気圧センサ１６から供給される出力信号に基づいてタイヤの空気圧を検出する。不揮発性メモリ２０には、車両に取り付けられているタイヤを識別するためのタイヤ識別符号ＩＤが記録さ

れている。送信ＣＰＵ１８は、タイヤ空気圧センサ１６からの出力信号に基づいて検出したタイヤの空気圧（以下、検出値Ｐｍとする）と、その検出値Ｐｍに対応するタイヤのタイヤ識別符号ＩＤを送信回路２２に供給する。送信回路２２は、検出値Ｐｍ及びタイヤ識別符号ＩＤを含む無線信号を送信アンテナ２２を介して監視ユニット１２側へ送信する。この無線信号の送信は、所定時間毎に繰り返し行われる。

【００１１】監視ユニット１２は、受信回路２６、受信ＣＰＵ２８、不揮発性メモリ３０、タイヤセット選択スイッチ（ＳＷ）３２、表示警告装置３４を備えている。また、監視ユニット１２には、受信アンテナ３６が取り付けられている。監視ユニット１２は、車両内に配置されており、車両が備える図示しないバッテリーを電源として駆動される。

【００１２】受信回路２６は、受信アンテナ３６を介してセンサユニット１０から送信された無線信号を受信し、この信号に含まれる検出値Ｐｍ及びタイヤ識別符号ＩＤを受信ＣＰＵ２８に供給する。受信ＣＰＵ２８は、供給されたタイヤ識別符号ＩＤと不揮発性メモリ３０に予め登録されているタイヤ識別符号ＩＤ（登録識別符号ＩＤ）を比較することにより、受信した信号がどの位置（左前輪、右前輪、左後輪、右後輪）のタイヤに関するものであるかを特定する。また、受信ＣＰＵ２８は、受信した検出値Ｐｍに基づいて、タイヤ空気圧の異常発生の有無を判定する。不揮発性メモリ３０には、複数のタイヤセット（例えば、スタンダードタイヤとスタッドレスタイヤの２セット）のタイヤ識別符号ＩＤが記録されている。

【００１３】図２は、不揮発性メモリ３０のアドレスと登録内容の関係を示す図である。図２に示すように、不揮発性メモリ３０のアドレス＃０～＃４には、スタンダードタイヤのタイヤ識別符号ＩＤＡ１～ＩＤＡ５が登録されている。ＩＤＡ１は左前輪のタイヤ識別符号ＩＤであり、ＩＤＡ２は右前輪のタイヤ識別符号ＩＤであり、ＩＤＡ３は左後輪のタイヤ識別符号ＩＤであり、ＩＤＡ４は右後輪のタイヤ識別符号ＩＤである。また、ＩＤＡ５は、スタンダードタイヤのスペアタイヤのタイヤ識別符号ＩＤである。

【００１４】また、不揮発性メモリ３０のアドレス＃５～＃９には、スタッドレスタイヤのタイヤ識別符号ＩＤＢ１～ＩＤＢ５が登録されている。ＩＤＢ１は左前輪のタイヤ識別符号ＩＤであり、ＩＤＢ２は右前輪のタイヤ識別符号ＩＤであり、ＩＤＢ３は左後輪のタイヤ識別符号ＩＤであり、ＩＤＢ４は右後輪のタイヤ識別符号ＩＤである。また、ＩＤＢ５は、スタッドレスタイヤのスペアタイヤのタイヤ識別符号ＩＤである。

【００１５】不揮発性メモリ３０に登録されている互いに異なるタイヤ識別符号ＩＤのうち、いずれのタイヤセットのタイヤ識別符号ＩＤを使用するかはタイヤセット選択スイッチ３２によって指示することができる。なお、車両にスペアタイヤを搭載していない場合は、センサユニット１０から監視ユニット１２にスペアタイヤに関する無線信号は送信されない。この時、不揮発性メモリ３０のアドレス＃４、＃９にスペアタイヤのタイヤ識別符号ＩＤＡ５、ＩＤＢ５が登録されていると、スペアタイヤから所定時間以上、無線信号が送信されないので、受信ＣＰＵ２８がスペアタイヤに、例えば、電池切れ等の異常が発生したと判断してしまう可能性がある。そこで、車両にスペアタイヤが搭載されていない時は、スペアタイヤのタイヤ識別符号ＩＤが登録されるアドレス＃４、＃９に所定値（例えば、オールゼロ）が登録される。

【００１６】また、不揮発性メモリ３０には、所定の第１～第３の警報値Ｐ１、Ｐ２、Ｐ３（Ｐ１＞Ｐ２＞Ｐ３）が記録されている。受信ＣＰＵ２８は、センサユニット１０から送信された無線信号に含まれる検出値Ｐｍが第１～第３の警報値Ｐ１、Ｐ２、Ｐ３を下回った場合に、表示警告装置３４に警告を行わせる。第１～第３の警報値Ｐ１、Ｐ２、Ｐ３は、それぞれ大気圧を基準に設定されている。また、受信ＣＰＵ２８は、所定時間毎に繰り返し無線信号を受信し、検出値Ｐｍと第１～第３の警報値Ｐ１、Ｐ２、Ｐ３の比較を行う。

【００１７】表示警告装置３４は、図示しない第１警告灯、第２警告灯、第３警告灯を有している。表示警告装置３４は、タイヤ空気圧の数値表示を行うと共に、タイヤ空気圧に異常が発生した場合に、第１～第３警告灯にてタイヤ空気圧に異常が発生したことを伝える警告を行う。例えば、検出値Ｐｍが第１の警報値Ｐ１を下回った場合に、第１警告灯の点灯によってタイヤ空気圧の初期的な低下を示す警報（第１の警報）が発せられる。また、検出値Ｐｍが第２の警報値Ｐ２を下回った場合に、第２警告灯の点灯によってタイヤのバンクを示す警報（第２の警報）が発せられる。更に、検出値Ｐｍが第３の警報値Ｐ３を下回った場合に、第３警告灯の点灯によってタイヤの空気が完全に抜けて空気圧がゼロであることを示す警報（第３の警報）が発せられる。

【００１８】なお、不揮発性メモリ３０が記録する警報値の数は３つに限定されるものではなく、１つ又は２つ、あるいは、４つ以上の警報値を不揮発性メモリ３０が記録するような構成としてもよい。また、第１～第３警告灯に代えて、例えば、ブザー等の音響によって警報を発する警報装置を車両内に設けてもよい。図３は、タイヤ空気圧Ｐｍの伝達時にセンサユニット１０から監視ユニット１２に送信される無線信号のデータフォーマットの一例を示す図である。

【００１９】図３に示すように、タイヤ空気圧Ｐｍを伝える通常動作時の無線信号のフレームフォーマットの先頭には、同期用のスタートビットが設けられている。そして、スタートビットに続いて、送信元のタイヤを識別

させるためのタイヤ識別符号ＩＤ及び送信元のタイヤの空気圧Ｐｍのコードが配置されており、最後に、同期用のストップビットが設けられている。

【００２０】図４は、タイヤ識別符号ＩＤの登録時にセンサユニット１０から監視ユニット１２に送信される無線信号のフレームフォーマットの一例を示す図である。図４に示すように、タイヤ識別符号ＩＤの登録時に送信される無線信号のフレームフォーマットの先頭には、同期用のスタートビットが設けられている。そして、スタートビットに続いて、送信元のタイヤを識別させるためのタイヤ識別符号ＩＤが２回連続して配置されており、最後に、同期用のストップビットが設けられている。なお、タイヤ識別符号ＩＤの登録時に用いられる無線信号のフレームフォーマットは、図４に示すフォーマットに限定されるものではなく、他のフォーマットでもよい。また、タイヤ識別符号ＩＤの登録時に用いられる無線信号のフレームフォーマットは、図３に示す通常動作時のフレームフォーマットと同じでもよい。

【００２１】図３及び図４に示すように、タイヤ識別符号ＩＤの登録時にセンサユニット１０から監視ユニット１２に送信される無線信号のフレームフォーマットと、タイヤ空気圧Ｐｍを伝える無線信号のフレームフォーマットとが異なる場合、タイヤ識別符号ＩＤの登録時に、他の車両から送信されたタイヤ空気圧Ｐｍを伝える無線信号に含まれるタイヤ識別符号ＩＤが誤登録されることが防止される。

【００２２】ところで、不揮発性メモリ３０へのタイヤ識別符号ＩＤの登録は、車両生産工場で車両に最初にタイヤを取り付けた時やタイヤ交換（ローテーション）を行った時、故障したセンサユニット１０を交換した時等に行われる。不揮発性メモリ３０にタイヤ識別符号ＩＤを登録するには、先ず、車両内に設けられた図示しない登録スイッチを操作して登録モードとする。そして、所定時間内に予め決められている順番（例えば、左前輪、右前輪、左後輪、右後輪、スペアタイヤの順）でタイヤ識別符号ＩＤを登録していく。この時、受信ＣＰＵ２８が各タイヤのタイヤ識別符号ＩＤを不揮発性メモリ３０に記録していく。なお、登録スイッチで特定のタイヤを指定して、指定したタイヤのタイヤ識別符号ＩＤのみを登録することも可能である。

【００２３】不揮発性メモリ３０に登録すべきタイヤ識別符号ＩＤの数ｎは、車両によって異なる。例えば、スタンダードタイヤとスタッドレスタイヤを交互に使用する車両の場合、不揮発性メモリ３０に登録すべきタイヤ識別符号ＩＤの数ｎは、スペアタイヤ分を含めて、５×２＝１０となる。次に、タイヤ識別符号ＩＤの登録時に受信ＣＰＵ２８が実行するルーチンについて説明する。ここでは、受信ＣＰＵ２８がｎ個のタイヤ識別符号ＩＤを不揮発性メモリ３０に登録する場合について説明する。

【００２４】図５は、受信ＣＰＵ２８が実行するルーチンのフローチャートである。このルーチンは登録スイッチにて登録モードとされた時に起動される。図５に示すルーチンが起動されると、先ず、ステップ１００の処理が実行される。ステップ１００では、センサユニット１０から送信された無線信号が受信アンテナ３６及び受信回路２６を介して受信される。そして、次に、ステップ１０２の処理が実行される。

【００２５】ステップ１０２では、受信した無線信号がセンサユニット１０からのものであるか否かが判定される。この判定は、受信した無線信号のフレームフォーマットに基づいて行われる。具体的には、受信部は、予め記憶したセンサユニット１０から送信されるはずの無線信号のフレームフォーマットと、実際に受信した無線信号のフレームフォーマットを比較する。

【００２６】ステップ１０２において、受信した無線信号のフレームフォーマットがセンサユニット１０が送信する無線信号のデータフォーマットと異なる場合、受信した無線信号は、センサユニット１０からのものではないと判断され、次に、ステップ１００の処理が実行される。一方、ステップ１０２において、受信した無線信号のフレームフォーマットがセンサユニット１０が送信する無線信号のフレームフォーマットと一致する場合、次に、ステップ１０４の処理が実行される。

【００２７】ステップ１０４では、無線信号に含まれるタイヤ識別符号ＩＤが確認される。そして、次に、ステップ１０６の処理が実行される。ここで、登録モード中には、複数の無線信号が受信される。従って、ステップ１０４では、複数のタイヤ識別符号ＩＤが確認される。ステップ１０６では、タイヤ識別符号ＩＤ毎の受信回数がカウントされる。そして、カウントされた受信回数は、監視ユニット１２が備える図示しないメモリに記録される。ステップ１０６の処理が終了すると、次に、ステップ１０８の処理が実行される。

【００２８】ステップ１０８では、登録モードになってから予め設定された時間Ｔが経過し、かつ、不揮発性メモリ３０に登録すべきｎ個のタイヤ識別符号ＩＤと同数又はそれ以上の数の互いに異なるタイヤ識別符号ＩＤが受信されたか否かが判定される。ステップ１０８において、登録モードになってから時間Ｔが経過していない場合や不揮発性メモリ３０に登録すべきｎ個のタイヤ識別符号ＩＤと同数又はそれ以上の数の互いに異なるタイヤ識別符号ＩＤが受信されていない場合は、次に、ステップ１００の処理が実行される。一方、ステップ１０８において、登録モードになってから時間Ｔが経過し、かつ、不揮発性メモリ３０に登録すべきｎ個のタイヤ識別符号ＩＤと同数又はそれ以上の数の互いに異なるタイヤ識別符号ＩＤが受信されたと判断される場合、次に、ステップ１１０の処理が実行される。なお、時間Ｔは、自車両のセンサユニット１０が少なくとも２回無線送信を

行うだけの長さを有するものとする。

【００２９】ステップ１１０では、受信されたタイヤ識別符号ＩＤのうち、受信頻度が多い方からｎ個の互いに異なるタイヤ識別符号ＩＤが不揮発性メモリ３０に登録される。そして、今回のルーチンは終了となる。自車両に取り付けられたタイヤ内のセンサユニット１０は、監視ユニット１２にとって、最も近くに設けられたタイヤ識別符号ＩＤを含む無線信号の送信機である。このため、自車両以外から送信された無線信号に比して、自車両のセンサユニット１０が送信する無線信号は確実に監視ユニット１２に受信される。この結果、所定時間内に監視ユニット１２が受信するタイヤ識別符号ＩＤを含む無線信号は、自車両に取り付けられたタイヤ内のセンサユニット１０からのものが最も多くなる。従って、ステップ１１０に示すように、受信頻度の高い方からｎ個の互いに異なるタイヤ識別符号ＩＤを不揮発性メモリ３０に登録する構成とすることで、自車両に取り付けられたタイヤに関するタイヤ識別信号ＩＤのみが確実に登録される。

【００３０】なお、上記実施例において、センサユニット１０及び監視ユニット１２がそれぞれ特許請求の範囲に記載の送信部及び受信部に相当し、不揮発性メモリ３０に登録されたｎ個のタイヤ識別符号ＩＤが特許請求の範囲に記載の所定個数の登録識別符号に相当する。

【００３１】

【発明の効果】上述の如く、請求項１記載の発明によれば、受信部が所定時間内に受信したタイヤ識別符号のうち、受信頻度の高い方から所定個数のタイヤ識別符号が登録識別符号として記憶される。受信部にとって、同一の車両に取り付けられた送信部が最も近くに設けられたタイヤ識別符号の送信機であるため、所定時間内に受信部が受信するタイヤ識別符号は、同一の車両に取り付けられた送信部からのものが最も多くなる。

＊【００３２】従って、本発明によれば、登録モード時に、受信部が所定時間内に受信されたタイヤ識別符号のうち受信頻度の高い方から所定個数のタイヤ識別符号を登録識別符号として記憶することで、自車両に取り付けられたタイヤに関するタイヤ識別信号のみを確実に記憶することができる。

【図面の簡単な説明】

【図１】本発明の一実施例であるタイヤ空気圧警報装置のシステム構成図である。

【図２】不揮発性メモリのアドレスと登録内容の関係を示す図である。

【図３】タイヤ空気圧の伝達時にセンサユニットから監視ユニットに送信される無線信号のデータフォーマットの一例を示す図である。

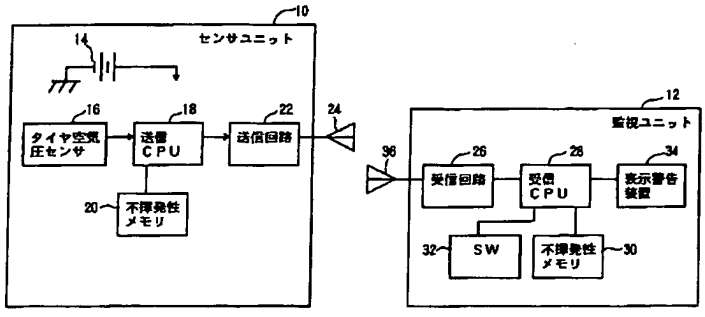
【図４】タイヤ識別符号の登録時にセンサユニットから監視ユニットに送信される無線信号のフレームフォーマットの一例を示す図である。

【図５】受信ＣＰＵが実行するルーチンのフローチャートである。

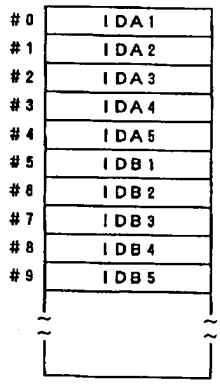
【符号の説明】

１０　センサユニット
１２　監視ユニット
１６　タイヤ空気圧センサ
１８　送信ＣＰＵ
２０、３０　不揮発性メモリ
２２　送信回路
２４　送信アンテナ
２６　受信回路
２８　受信ＣＰＵ
３２　タイヤセット選択スイッチ
３４　表示警告装置
３６　受信アンテナ

【図１】



【図２】



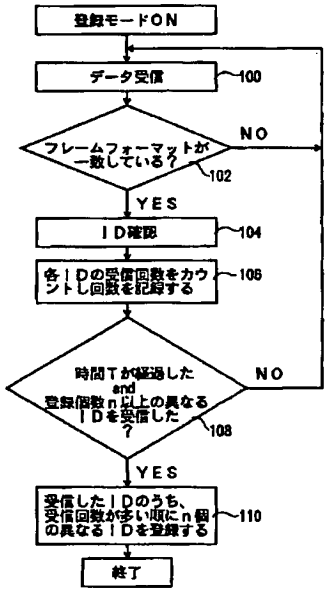
【図３】

スタートビット	タイヤ識別符号 ＩＤ	タイヤ空気圧 Ｐｍ	ストップビット

【図４】

スタートビット	タイヤ識別符号 ＩＤ	タイヤ識別符号 ＩＤ	ストップビット

【図５】



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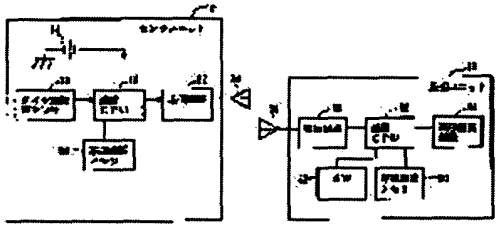
(54) TIRE INFLATION PRESSURE WARNING DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a tire inflation pressure warning device surely registering only a tire discrimination code of a tire mounted in a self vehicle.

SOLUTION: Tire inflation pressure information and a tire discrimination code ID are transmitted from a sensor unit 10 provided in each tire. A receiver CPU 28 provided in a supervisory unit 12 compares the received tire discrimination code ID with a tire discrimination code ID previously registered in a non- volatile memory 30, to specify a tire transmitting a signal. In the case of registering the tire discrimination code ID in the non-volatile memory 30, the receiver CPU 28 registers a quantity n of the tire discrimination codes ID from that of higher frequency of receiving of the tire discrimination codes received during the prescribed time T.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2. *** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to a tire-pressure alarm, and relates to a tire-pressure alarm equipped with the transmitting section which transmits the information about the pneumatic pressure of the tire especially built in each tire, and the receive section which receives the information about the pneumatic pressure of the tire transmitted from the transmitting section.
[0002]
[Description of the Prior Art] Conventionally based on the radio signal containing the measured value of the pneumatic pressure of a tire, it judges whether the pneumatic pressure of a tire is outlying observation, and when it is outlying observation, the tire-pressure alarm which emits an alarm is known widely. Such a tire-pressure alarm is equipped with the transmitting section prepared in each tire, and the receive section which receives the radio signal transmitted from the transmitting section.
[0003] The transmitting section measures the pneumatic pressure of a tire and carries out radio transmission of the tire identification code ID for discriminating the measured value and tire. A receive section receives the radio signal transmitted from the transmitting section, and judges the existence of the heterology of a tire pressure. The tire identification code ID of all the tires with which vehicles are equipped is beforehand registered into the memory which a receive section has. A receive section specifies of which tire the tire-pressure information which compares the tire identification code ID contained in the radio signal which received with the tire identification code ID registered into memory, and is included in the radio signal which received is a thing. In case the tire identification code ID attaches a tire in vehicles, it is registered into memory. For example, in the tire-pressure alarm indicated by JP,9-210827,A, a receive section is registered as a tire identification code ID from the transmitting section in which four tire identification codes ID which received first were formed in the tire of self-vehicles.
[0004]
[Problem(s) to be Solved by the Invention] A receive section may receive the radio signal from the transmitting section with which the tire attached in other vehicles is equipped etc. Possibility of receiving the radio signal about the tire with which the receive section was attached in other vehicles is high in especially the place where many vehicles, such as vehicles production works, crowd.
[0005] Therefore, with the composition which registers into memory four tire identification codes ID which received first like the above-mentioned conventional example, the tire identification code ID about the tire of other vehicles may be incorrect-registered. this invention is made in view of the point describing above, and aims at offering the tire-pressure alarm with which the tire identification code ID of the tire attached in self-vehicles is registered certainly.
[0006]
[Means for Solving the Problem] The transmitting section which the above-mentioned purpose detects the pneumatic pressure of a tire, and transmits the detected tire pressure with a tire identification code,

Receive the aforementioned tire pressure and the aforementioned tire identification code, and while specifying a tire as compared with the registration identification code of the predetermined number, this tire identification code It is a tire-pressure alarm equipped with the receive section which emits an alarm when a tire pressure is below a predetermined value. the aforementioned receive section It is attained in registration mode by the tire-pressure alarm which memorizes the tire identification code of the aforementioned predetermined number as the aforementioned registration identification code from the one among the tire identification codes which received in the predetermined time where receiving frequency is higher.
[0007] For a receive section, the transmitting section attached in the same vehicles is the transmitter of the tire identification code prepared most in near. For this reason, the thing of the tire identification code which a receive section receives in a predetermined time from the transmitting section attached in the same vehicles increases most. Therefore, only the tire recognition signal about the tire attached in self-vehicles is certainly memorized by considering as the composition the tire identification code of the predetermined number is remembered to be by the receive section as a registration identification code like this invention from the one where receiving frequency is higher among the tire identification codes received in the predetermined time at the time of registration mode.
[0008]
[Embodiments of the Invention] Drawing 1 is the system configuration view of the tire-pressure alarm which is one example of this invention. The tire-pressure alarm shown in drawing 1 is equipment which emits the alarm which tells the abnormalities of a tire pressure, when it falls beyond a predetermined value from the setting pneumatic pressure to which the pneumatic pressure of a tire was supervised and the tire pressure was set beforehand.
[0009] As shown in drawing 1 , the tire-pressure alarm of this example is equipped with the sensor unit 10 and the surveillance unit 12. The sensor unit 10 is attached in the interior of a wheel wheel, and drives the built-in cell 14 as a power supply. The sensor unit 10 is equipped with the tire-pressure sensor 16, transmission CPU 18, non-volatile memory 20, and the sending circuit 22. Moreover, the transmitting antenna 24 is attached in the sensor unit 10.
[0010] The tire-pressure sensor 16 is a sensor which outputs the signal according to the pneumatic pressure of a tire. The output signal of the tire-pressure sensor 16 is supplied to transmission CPU 18. Transmission CPU 18 detects the pneumatic pressure of a tire based on the output signal supplied from the tire-pressure sensor 16. The tire identification code ID for discriminating the tire attached in vehicles is recorded on non-volatile memory 20. Transmission CPU 18 supplies the tire identification code ID of the pneumatic pressure (it considers as the detection value Pm hereafter) of the tire detected based on the output signal from the tire-pressure sensor 16, and the tire corresponding to the detection value Pm to a sending circuit 22. A sending circuit 22 transmits the radio signal containing the detection value Pm and the tire identification code ID to the surveillance unit 12 side through the transmitting antenna 22. Transmission of this radio signal is repeatedly performed for every predetermined time.
[0011] The surveillance unit 12 is equipped with a receiving circuit 26, reception CPU 28, non-volatile memory 30, the tire set selecting switch (SW) 32, and the display warning device 34. Moreover, the receiving antenna 36 is attached in the surveillance unit 12. The surveillance unit 12 is arranged in vehicles and drives the dc-battery with which vehicles are equipped and which is not illustrated as a power supply.
[0012] A receiving circuit 26 receives the radio signal transmitted from the sensor unit 10 through the receiving antenna 36, and supplies the detection value Pm included in this signal, and the tire identification code ID to reception CPU 28. It specifies whether reception CPU 28 is a thing concerning [the signal received by comparing the supplied tire identification code ID with the tire identification code ID (registration identification code ID) beforehand registered into non-volatile memory 30] the tire of which position (a forward left ring, a forward right ring, a left rear ring, right rear ring). Moreover, reception CPU 28 judges the existence of the heterology of a tire pressure based on the received detection value Pm. The tire identification code ID of two or more tire sets (for example, two sets of a standard tire and a studless tire) is recorded on non-volatile memory 30.

[0013] Drawing 2 is drawing showing the address of non-volatile memory 30, and the relation of the content of registration. As shown in drawing 2 , the tire identification codes IDA1-IDA5 of a standard tire are registered into address #0-#4 of non-volatile memory 30. IDA2 is the tire identification code ID of a forward right ring, IDA1 is the tire identification code ID of a forward left ring, and IDA4 is [IDA3 is the tire identification code ID of a left rear ring, and] the tire identification code ID of a right rear ring. Moreover, IDA5 is the tire identification code ID of the spare tire of a standard tire.
[0014] Moreover, the tire identification codes IDB1-IDB5 of a studless tire are registered into address #5-#9 of non-volatile memory 30. IDB2 is the tire identification code ID of a forward right ring, IDB1 is the tire identification code ID of a forward left ring, and IDB4 is [IDB3 is the tire identification code ID of a left rear ring, and] the tire identification code ID of a right rear ring. Moreover, IDB5 is the tire identification code ID of the spare tire of a studless tire.
[0015] It can be directed by the tire set selecting switch 32 whether to use the tire identification code ID of which tire set among mutually different tire identification codes ID registered into non-volatile memory 30. In addition, when the spare tire is not carried in vehicles, the radio signal about a spare tire is not transmitted to the surveillance unit 12 from the sensor unit 10. If the tire identification codes IDA5 and IDB5 of a spare tire are registered into address #4 of non-volatile memory 30, and #9 at this time, since a radio signal will not be transmitted more than a predetermined time from a spare tire, reception CPU 28 may judge that abnormalities, such as for example, a cell piece, occurred in the spare tire. Then, when the spare tire is not carried in vehicles, a predetermined value (for example, all zero) is registered into address #4 into which the tire identification code ID of a spare tire is registered, and #9.
[0016] moreover, the 1- predetermined to non-volatile memory 30 -- the 3rd alarm value P1, P2, and P3 (P1>P2> P3) is recorded the detection value Pm included in the radio signal to which reception CPU 28 was transmitted from the sensor unit 10 -- the 1- when less than the 3rd alarm value P1, P2, and P3, it is made to warn the display warning device 34 the 1- the 3rd alarm value P1, P2, and P3 is set to criteria in atmospheric pressure, respectively moreover, the reception.CPU 28 -- every predetermined time -- repeating -- a radio signal -- receiving -- the detection value Pm and the 1- the 3rd alarm value P1, P2, and P3 is compared
[0017] The display warning device 34 has the 1st alarm lamp which is not illustrated, the 2nd alarm lamp, and the 3rd alarm lamp. The display warning device 34 performs warning which tells that abnormalities occurred to a tire pressure in the 1st - the 3rd alarm lamp, when abnormalities occur in a tire pressure, while performing the digital readout of a tire pressure. For example, when the detection value Pm is less than the 1st alarm value P1, the alarm (the 1st alarm) which shows the first stage-fall of a tire pressure by lighting of the 1st alarm lamp is emitted. Moreover, when the detection value Pm is less than the 2nd alarm value P2, the alarm (the 2nd alarm) which shows the blowout of a tire by lighting of the 2nd alarm lamp is emitted. Furthermore, when the detection value Pm is less than the 3rd alarm value P3, the alarm (the 3rd alarm) which the air of a tire falls out completely by lighting of the 3rd alarm lamp, and shows that pneumatic pressure is zero is emitted.
[0018] In addition, the number of the alarm values which non-volatile memory 30 records is good also as composition whose non-volatile memory 30 it is not limited to three and records one, two, or four alarm values or more. Moreover, you may prepare in vehicles the alarm which replaces with the 1st - the 3rd alarm lamp, for example, emits an alarm with sound, such as a buzzer. Drawing 3 is drawing showing an example of the data format of the radio signal transmitted to the surveillance unit 12 from the sensor unit 10 at the time of transfer of tire-pressure Pm.
[0019] As shown in drawing 3 , the start bit for a synchronization is prepared in the head of the frame format of the radio signal at the time of the normal operation which tells tire-pressure Pm. And the code of the tire identification code ID for making the tire of a transmitting agency discriminate and the pneumatic pressure Pm of the tire of a transmitting agency is arranged following the start bit, and, finally the stop bit for a synchronization is prepared.
[0020] Drawing 4 is drawing showing an example of the frame format of the radio signal transmitted to the surveillance unit 12 from the sensor unit 10 at the time of registration of the tire identification code ID. As shown in drawing 4 , the start bit for a synchronization is prepared in the head of the frame

format of the radio signal transmitted at the time of registration of the tire identification code ID. And the tire identification code ID for making the tire of a transmitting agency discriminate is continuously arranged twice following the start bit, and, finally the stop bit for a synchronization is prepared. In addition, the frame format of the radio signal used at the time of registration of the tire identification code ID may not be limited to the format shown in drawing 4 , and other formats are sufficient as it. moreover, the frame format at the time of the normal operation which shows the frame format of the radio signal used at the time of registration of the tire identification code ID to drawing 3 -- being the same .

[0021] As shown in drawing 3 and drawing 4 , when the frame format of the radio signal transmitted to the surveillance unit 12 from the sensor unit 10 at the time of registration of the tire identification code ID differs from the frame format of the radio signal which tells tire-pressure Pm, it is prevented that the tire identification code ID contained in the radio signal which tells tire-pressure Pm transmitted from other vehicles at the time of registration of the tire identification code ID is incorrect-registered.

[0022] By the way, registration of the tire identification code ID to non-volatile memory 30 is performed when the sensor unit 10 which broke down when the time of attaching a tire in vehicles first at vehicles production works and tire exchange (rotation) were performed is exchanged. In order to register the tire identification code ID into non-volatile memory 30, the registration switch which was formed in vehicles and which is not illustrated is operated first, and it considers as registration mode. And the tire identification code ID is registered in the turn (for example, a forward left ring, a forward right ring, a left rear ring, a right rear ring, order of a spare tire) beforehand decided in the predetermined time. At this time, reception CPU 28 records the tire identification code ID of each tire on non-volatile memory 30. In addition, it is also possible to register the tire identification code ID of the tire which specified the specific tire and was specified with a registration switch.

[0023] Several n of the tire identification code ID which should be registered into non-volatile memory 30 changes with vehicles. For example, in the case of the vehicles which use a standard tire and a studless tire by turns, several n of the tire identification code ID which should be registered into non-volatile memory 30 is set to 5x2=10 including a part for a spare tire. Next, the routine which reception CPU 28 performs at the time of registration of the tire identification code ID is explained. Here, the case where reception CPU 28 registers n tire identification codes ID into non-volatile memory 30 is explained.

[0024] Drawing 5 is the flow chart of the routine which reception CPU 28 performs. This routine is started when it considers as registration mode with a registration switch. Starting of the routine shown in drawing 5 performs processing of Step 100 first. At Step 100, the radio signal transmitted from the sensor unit 10 is received through a receiving antenna 36 and a receiving circuit 26. And next, processing of Step 102 is performed.

[0025] At Step 102, it is judged whether the radio signal which received is a thing from the sensor unit 10. This judgment is performed based on the frame format of the radio signal which received. Specifically, a receive section compares the frame format of the radio signal which should be transmitted from the sensor unit 10 memorized beforehand with the frame format of the radio signal which actually received.

[0026] In Step 102, when the frame format of the radio signal which received differs from the data format of the radio signal which the sensor unit 10 transmits, it is judged that the radio signal which received is not a thing from the sensor unit 10, next processing of Step 100 is performed. On the other hand, when the frame format of the radio signal which received is in agreement with the frame format of the radio signal which the sensor unit 10 transmits in Step 102 next, processing of Step 104 is performed.

[0027] At Step 104, the tire identification code ID contained in a radio signal is checked. And next, processing of Step 106 is performed. Here, two or more radio signals are received in registration mode. Therefore, at Step 104, two or more tire identification codes ID are checked. At Step 106, the number of times of reception for every tire identification code ID counts. And the counted number of times of reception is recorded on the memory with which the surveillance unit 12 is equipped and which is not

illustrated. An end of processing of Step 106 performs [next] processing of Step 108.
[0028] At Step 108, it is judged whether n tire identification codes ID, same numbers, or the number beyond it of mutually different tire identification codes ID which the time T set up beforehand passes after becoming registration mode, and should be registered into non-volatile memory 30 were received. In Step 108, after becoming registration mode, when n tire identification codes ID, same numbers, or the number beyond it of mutually different tire identification codes ID which should be registered into the case where Time T has not passed, or non-volatile memory 30 are not received next, processing of Step 100 is performed. On the other hand, after becoming registration mode, when it is judged in Step 108 that n tire identification codes ID, same numbers, or the number beyond it of mutually different tire identification codes ID which Time T passes and should be registered into non-volatile memory 30 were received next, processing of Step 110 is performed. In addition, Time T shall have only the length to which the sensor unit 10 of self-vehicles performs radio transmission twice [at least].
[0029] At Step 110, n mutually different tire identification codes ID are registered into non-volatile memory 30 from the direction with much receiving frequency among the received tire identification codes ID. And this routine is ended. The sensor unit 10 in the tire attached in self-vehicles is the transmitter of the radio signal containing the tire identification code ID prepared most in near for the surveillance unit 12. For this reason, as compared with the radio signal transmitted from other than self-vehicles, the radio signal which the sensor unit 10 of self-vehicles transmits is certainly received by the surveillance unit 12. Consequently, the thing of the radio signal containing the tire identification code ID which the surveillance unit 12 receives in a predetermined time from the sensor unit 10 in the tire attached in self-vehicles increases most. Therefore, as shown in Step 110, the tire recognition signal ID about the tire attached in self-vehicles is certainly registered by considering as the composition which registers n mutually different tire identification codes ID into non-volatile memory 30 from the one where receiving frequency is higher.
[0030] In addition, in the above-mentioned example, the sensor unit 10 and the surveillance unit 12 are equivalent to the transmitting section and a receive section given in a claim, respectively, and n tire identification codes ID registered into non-volatile memory 30 are equivalent to the registration identification code of the predetermined number given in a claim.
[0031]
[Effect of the Invention] According to invention according to claim 1, like ****, the tire identification code of the predetermined number is memorized as a registration identification code from the one among the tire identification codes which the receive section received in the predetermined time where receiving frequency is higher. Since the transmitting section attached in the same vehicles is the transmitter of the tire identification code prepared most in near for a receive section, the thing of the tire identification code which a receive section receives in a predetermined time from the transmitting section attached in the same vehicles increases most.
[0032] Therefore, according to this invention, only the tire recognition signal about the tire attached in self-vehicles by memorizing the tire identification code of the predetermined number as a registration identification code from the one where receiving frequency is higher among the tire identification codes by which the receive section was received in the predetermined time at the time of registration mode is certainly memorizable.

[Translation done.]

* NOTICES *

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3.In the drawings, any words are not translated.

PRIOR ART

[Description of the Prior Art] Conventionally based on the radio signal containing the measured value of the pneumatic pressure of a tire, it judges whether the pneumatic pressure of a tire is outlying observation, and when it is outlying observation, the tire-pressure alarm which emits an alarm is known widely. Such a tire-pressure alarm is equipped with the transmitting section prepared in each tire, and the receive section which receives the radio signal transmitted from the transmitting section.
[0003] The transmitting section measures the pneumatic pressure of a tire and carries out radio transmission of the tire identification code ID for discriminating the measured value and tire. A receive section receives the radio signal transmitted from the transmitting section, and judges the existence of unusual generating of a tire pressure. The tire identification code ID of all the tires with which vehicles are equipped is beforehand registered into the memory which a receive section has. A receive section specifies of which tire the tire-pressure information which compares the tire identification code ID contained in the radio signal which received with the tire identification code ID registered into memory, and is included in the radio signal which received is a thing. In case the tire identification code ID attaches a tire in vehicles, it is registered into memory. For example, in the tire-pressure alarm indicated by JP,9-210827,A, a receive section is registered as a tire identification code ID from the transmitting section in which four tire identification codes ID which received first were formed in the tire of self-vehicles.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the system configuration view of the tire-pressure alarm which is one example of this invention.
[Drawing 2] It is drawing showing the address of non-volatile memory, and the relation of the content of registration.
[Drawing 3] It is drawing showing an example of the data format of the radio signal transmitted to a surveillance unit from a sensor unit at the time of transfer of a tire pressure.
[Drawing 4] It is drawing showing an example of the frame format of the radio signal transmitted to a surveillance unit from a sensor unit at the time of registration of a tire identification code.
[Drawing 5] It is the flow chart of the routine which Reception CPU performs.
[Description of Notations]
10 Sensor Unit
12 Surveillance Unit
16 Tire-Pressure Sensor
18 Transmission CPU
20 30 Non-volatile memory
22 Sending Circuit
24 Transmitting Antenna
26 Receiving Circuit
28 Reception CPU
32 Tire Set Selecting Switch
34 Display Warning Device
36 Receiving Antenna

[Translation done.]

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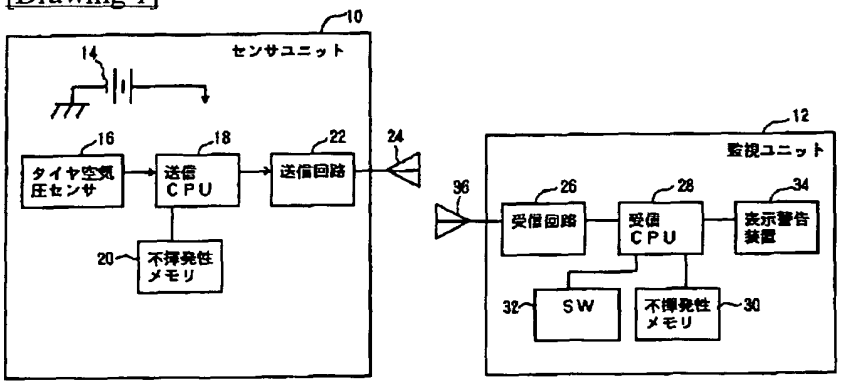
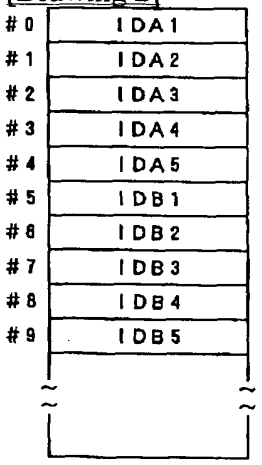
DRAWINGS

[Drawing 1]



[Drawing 2]



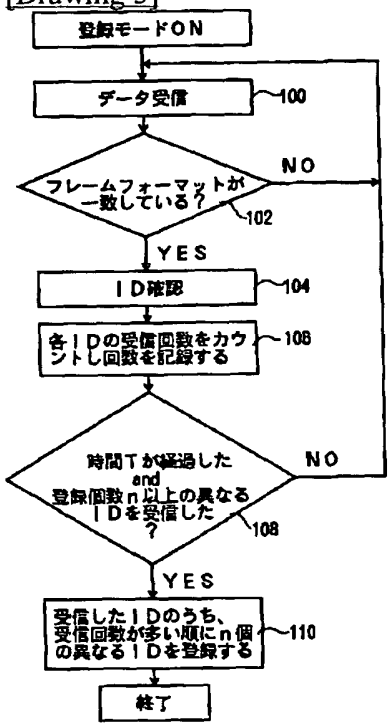
[Drawing 3]

スタートビット	タイヤ識別符号 ID	タイヤ空気圧 Pm	ストップビット

[Drawing 4]

スタートビット	タイヤ識別符号 ID	タイヤ識別符号 ID	ストップビット

[Drawing 5]



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TITLE OF THE INVENTION
VEHICLE WHEEL INFORMATION OBTAINING APPARATUS AND WHEEL INFORMATION PROCESSING APPARATUS

This application is based on Japanese Patent Application No. 2002-075517 filed on March 19, 2002, the content of which is incorporated hereinto by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The present invention relates in general to a vehicle wheel information obtaining apparatus for obtaining wheel information relating to a vehicle wheel, and more particularly to techniques for registration of an identification data identifying the wheel.

Discussion of Related Art

[0002] JP-A-2000-233615 discloses a vehicle wheel information obtaining apparatus to be installed on a vehicle, for registering wheel identification information identifying wheels of the vehicle. In this apparatus in which a data communication is established between each local unit provided on a corresponding one of the wheels and a central unit provided on a body of the vehicle, a number of receptions of each identification code by the central unit within a predetermined length of time is counted. It is determined that ones of the identification codes, each of which has been received a relatively large number of times within the predetermined length of time, has been transmitted from the respective wheels of the vehicle in question, rather than from wheels of another vehicle. Thus, the ones of the identification

codes received by the central unit with relatively high frequency are registered as the wheel identification data identifying the wheels of the vehicle in question. This arrangement is effective to avoid an erroneous registration in which the identification codes transmitted from the other vehicle are registered as the wheel identification data, even if the other vehicle is positioned close to the vehicle in question.

[0003] However, this vehicle wheel information obtaining apparatus disclosed by the Japanese publication suffers from a problem that the apparatus requires a large length of time for completing the registration of the wheel identification information.

SUMMARY OF THE INVENTION

[0004] It is therefore an object of the present invention to provide a vehicle wheel information obtaining apparatus or a vehicle wheel information processing apparatus which is capable of registering the wheel identification information in a reduced length of time, while reliably avoiding an erroneous registration in which the identification codes transmitted from another vehicle are undesirably registered as the wheel identification data, even if the other vehicle is positioned close to the vehicle in question. This object may be achieved by a vehicle wheel information obtaining apparatus or a vehicle wheel information processing apparatus constructed according to any one of the following modes of the present invention, each of which is numbered like the appended claims and depends from the other mode or modes,

where appropriate, to indicate and clarify possible combinations of elements or technical features. It is to be understood that the present invention is not limited to the technical features or any combinations thereof which will be described for illustrative purpose only. It is to be further understood that a plurality of elements or features included in any one of the following modes of the invention are not necessarily provided all together, and that the invention may be embodied without some of the elements or features described with respect to the same mode.

[0005] (1) A vehicle wheel information obtaining apparatus for obtaining wheel information relating to a wheel of a vehicle, the apparatus comprising:

a wheel state detector which is provided on the wheel and which detects a state of the wheel;

a transmitter which is provided on the wheel and which transmits a wheel data set, as the wheel information, containing a wheel state data representing the detected state of the wheel and a wheel identification data identifying the wheel;

a receiver which is provided on a body of the vehicle and which receives the wheel data set transmitted by the transmitter;

a data processor which processes the wheel data set received by the receiver, the data processor being selectively placed in an identification-data registering mode for registering the wheel identification data contained in the wheel data set, and a wheel-state data obtaining mode for obtaining the wheel state data contained in the wheel data set; and

a communication-intensity reducing device which reduces at least one of a transmission strength of the transmitter and a reception sensitivity of the receiver, such that the above-described at least one of the transmission strength and the reception sensitivity is lower when the data processor is in the identification-data registering mode, than when the data processor is in the wheel-state data obtaining mode.

[0006] In the vehicle wheel information obtaining apparatus described in this mode (1), at least one of the transmission strength of the transmitter and the reception sensitivity of the receiver is reduced to be lower in the identification-data registering mode, than in the wheel-state-data obtaining mode. This arrangement is effective to avoid the receiver from receiving wheel data sets transmitted from another vehicle, and accordingly avoid an erroneous registration in which the wheel data sets of the other vehicle is undesirably registered. Further, this arrangement does not require a large length of time for correctly registering the wheel data sets, unlike the above-described conventional apparatus in which the registration is effected depending on the frequency of the reception of each wheel data set.

[0007] In the identification-data registering mode, either one of the transmission strength of the transmitter and the reception sensitivity of the receiver may be reduced. Where the transmission strength of the wheel data set transmitted from each wheel of the subject vehicle and that of the wheel data set transmitted from each wheel of the other vehicle (positioned close

to the subject vehicle) are substantially equal to each other, the reduction in the reception sensitivity of the receiver (provided on the body of the subject vehicle) makes it possible to enable the receiver to receive the wheel data set transmitted from each wheel of the subject vehicle and to disable the receiver to receive the wheel data set transmitted from each wheel of the other vehicle. Thus, it is possible to avoid the wheel data sets, transmitted from the wheels of the other vehicle, from being erroneously registered as the wheel information. Further, where the reception sensitivity of the receiver of the subject vehicle and that of the receiver of the other vehicle are substantially equal to each other, the reduction in the transmission strengths of the wheel data sets transmitted from the subject vehicle and the other vehicle makes it possible to enable the receiver (provided on the body of the subject vehicle) to receive the wheel data set transmitted from each wheel of the subject vehicle and to disable the receiver to receive the wheel data set transmitted from each wheel of the other vehicle. In this case, too, it is possible to avoid the wheel data sets, transmitted from the wheels of the other vehicle, from being erroneously registered as the wheel information. It is noted that the term "wheel data set" may be referred also to as "tire data set".

[0008] (2) A vehicle wheel information obtaining apparatus according to mode (1), wherein the communication-intensity reducing device reduces the reception sensitivity of the receiver, such that the reception sensitivity is lower when the data processor is in the identification-data registering mode, than

when the data processor is in the wheel-state data obtaining mode.

[0009] (3) A vehicle wheel information obtaining apparatus according to mode (1) or (2), further comprising:

a communication-intensity increasing device which is operable when registration of the wheel identification data is completed, to increase the above-described at least one of the transmission strength and the reception sensitivity that has been reduced by the communication-intensity reducing device.

[0010] In the vehicle wheel information obtaining apparatus of this mode (3), the above-described at least one of the transmission strength of the transmitter and the reception sensitivity of the receiver is increased after the registration of the identification data has been completed, so that the wheel state data is assuredly received by the receiver during the wheel-state data obtaining mode.

[0011] (4) A vehicle wheel information obtaining apparatus according to any one of modes (1)-(3),

wherein each of at least one of the transmitter and the receiver is placed in a selected one of a plurality of different operation modes,

and wherein the plurality of different operating modes include a relatively high intensity mode in which a corresponding one of the transmission strength and the reception sensitivity is relatively high, and a relatively low intensity mode in which a corresponding one of the transmission strength and the reception sensitivity is relatively low.

[0012] Each of the above-described at least one of the transmission strength of the transmitter and the reception sensitivity of the receiver may be variable continuously, or alternatively, changed in a plurality of steps. In the latter case, each of at least one of the transmitter and the receiver preferably has at least two operation modes including, for example, the relatively high intensity mode and the relatively low intensity mode, so that the relatively high intensity mode (e.g., a relatively high reception-sensitivity mode) can be established in response to the switching of the data processor from the identification-data registering mode to the wheel-state data obtaining mode, while the relatively low intensity mode (e.g., a relatively low reception-sensitivity mode) can be established in response to the switching of the data processor from the wheel-state data obtaining mode to the identification-data registering mode. It is noted that controlling or adjusting the reception sensitivity of the receiver provided on the vehicle body is easier than controlling or adjusting the transmission strength of the transmitter provided on the wheel.

[0013] (5) A vehicle wheel information obtaining apparatus according to any one of modes (1)-(4), wherein the communication-intensity reducing device reduces each of the above-described at least one of the transmission strength and the reception sensitivity, to a minimum level required to enable the wheel data set to be received by the receiver when a rotational speed of the wheel is not higher than a predetermined value.

[0014] In the vehicle wheel information obtaining apparatus

of this mode (5), each of the above-described at least one of the transmission strength and the reception sensitivity is reduced to the minimum level required to enable the wheel data set to be received by the receiver when the rotational speed of the wheel is not higher than the predetermined value. This arrangement is effective to prevent the wheel data sets transmitted from the wheels of the other vehicle, from being received by the receiver of the subject vehicle. Since the registration of the identification data is made commonly when the vehicle is held stationary, the above-described predetermined value may be determined such that the vehicle is considered to be held substantially stationary when the rotational speed of the wheel is not higher than the predetermined value.

[0015] (6) A vehicle wheel information obtaining apparatus according to any one of modes (1)-(5), wherein the communication-intensity reducing device reduces each of the above-described at least one of the transmission strength and the reception sensitivity, to a minimum level required to enable the wheel data set to be received by the receiver when the receiver does not receive a noise whose level is higher than a predetermined value.

[0016] It is common that the level of the noise or other disturbance affecting the receiver is lower when the vehicle is held stationary, than when the vehicle is running. In the vehicle wheel information obtaining apparatus of this mode (6), each of the above-described at least one of the transmission strength and the reception sensitivity is reduced to the minimum level required

to enable the wheel data set to be received by the receiver when the disturbance level is not higher than the predetermined value.

[0017] (7) A vehicle wheel information obtaining apparatus according to any one of modes (1)-(6), wherein the communication-intensity reducing device reduces each of the above-described at least one of the transmission strength and the reception sensitivity, to a level that enables the receiver to receive the wheel data set transmitted from the wheel of the vehicle and that disables the receiver to receive a wheel data set transmitted from a wheel of another vehicle.

[0018] (8) A vehicle wheel information obtaining apparatus for obtaining wheel information relating to a wheel of a vehicle, the apparatus comprising:

a wheel state detector which is provided on the wheel and which detects a state of the wheel;

a transmitter which is provided on the wheel and which transmits a wheel data set, as the wheel information, containing a wheel state data representing the detected state of the wheel and a wheel identification data identifying the wheel;

a receiver which is provided on a body of the vehicle and which receives the wheel data set transmitted by the transmitter;

a data processor which processes the wheel data set received by the receiver, the data processor having an identification-data registering mode for registering the wheel identification data contained in the wheel data set, and a wheel-state data obtaining mode for obtaining the wheel state

data contained in the wheel data set; and

a communication-intensity changing device which changes at least one of a transmission strength of the transmitter and a reception sensitivity of the receiver, such that the above-described at least one of the transmission strength and the reception sensitivity varies depending upon whether the data processor is in the identification-data registering mode or in the wheel-state data obtaining mode.

[0019] The technical feature described in any one of the above modes (1)-(7) is applicable to the vehicle wheel information obtaining apparatus of this mode (8).

[0020] (9) A vehicle wheel information processing apparatus for processing wheel information relating to a wheel of a vehicle, the apparatus comprising:

a receiver which is provided on a body of the vehicle and which receives a wheel data set, as the wheel information, containing a wheel state data representing a state of the wheel and a wheel identification data identifying the wheel;

a data processor which processes the wheel data set received by the receiver, the data processor having an identification-data registering mode for registering the wheel identification data contained in the wheel data set, and a wheel-state data obtaining mode for obtaining the wheel state data contained in the wheel data set; and

a reception-sensitivity reducing device which reduces a reception sensitivity of the receiver, such that the reception sensitivity is lower when the data processor is in the

identification-data registering mode, than when the data processor is in the wheel-state data obtaining mode.

[0021] The technical feature described in any one of the above modes (1)-(8) is applicable to the vehicle wheel information processing apparatus of this mode (9).

[0022] (10) A vehicle wheel information processing apparatus for processing wheel information relating to a wheel of a vehicle, the apparatus comprising:

a receiver which is provided on a body of the vehicle and which receives a wheel data set, as the wheel information, containing a wheel state data representing a state of the wheel and a wheel identification data identifying the wheel;

a data processor which processes the wheel data set received by the receiver; and

a reception-sensitivity reducing device which reduces a reception sensitivity of the receiver, such that the reception sensitivity is lower when a rotational speed of the wheel is not higher than a predetermined value, than when the rotational speed of the wheel is higher than the predetermined value.

[0023] The technical feature described in any one of the above modes (1)-(9) is applicable to the vehicle wheel information processing apparatus of this mode (10).

BRIEF DESCRIPTION OF THE DRAWINGS

[0024] The above and other objects, features, advantages and technical and industrial significance of the present invention will be better understood by reading the following detailed

description of presently preferred embodiment of the invention, when considered in connection with the accompanying drawings, in which:

Fig. 1 is a schematic view showing a vehicle equipped with a wheel information obtaining apparatus which is constructed according to an embodiment of this invention;

Fig. 2 is a block diagram showing the wheel information obtaining apparatus of Fig. 1;

Fig. 3 is a view illustrating wheel information in the form of a wheel data set; and

Fig. 4 is a flow chart illustrating a data-reception controlling routine executed according to a control program stored in a memory of the wheel information obtaining apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0025] Referring to first to Figs. 1 and 2, there is shown a wheel information obtaining apparatus which is constructed according to an embodiment of this invention. As shown in Fig. 1, four tired wheels 10 are mounted as mounted wheels on axles of a vehicle which is provided with the wheel information obtaining apparatus, such that the four wheels serve as front right and left wheels FR, FL and rear right and left wheels RR, RL. Each of the wheels 10 is provided with a local unit 20, while a body 22 of the vehicle is provided with a central unit 24. A radio communication is established between each local unit 20 and the central unit 24, namely, between each wheel 10 and the vehicle body 22. As shown in Fig. 2, each local unit 20 includes: an air pressure sensor 30 for

detecting an air pressure of a tire of the corresponding wheel 10; a transmitting antenna 34 for transmitting a series of tire information in the form of a wheel data set 50 which contains an air pressure data representing the air pressure detected by the air pressure sensor 30 and an identification data identifying the corresponding wheel 10; and a wheel information generator 36 for generating the wheel data set. The wheel information generator 36 is constituted principally by a computer including a local memory 37 and input and output portions. To the input portion, there is connected the air pressure sensor 30. To the output portion, there is connected the transmitting antenna 34. The memory 37, constituted principally by a ROM and a RAM, serves as a data storage to store various information such as the above-described identification data. In the present embodiment of the invention, the transmitting antenna 34 and the wheel information generator 36 constitute a major portion of the transmitter 38.

[0026] As shown in Fig. 3, the wheel data set 50 includes a header data in the form of a synchronization data 52, an identification data 54, an air pressure data 56 and a check sum data 60. The synchronization data 52 is provided for synchronization of the transmitter 38 with a receiver. The identification data 54 is provided to identify each of the wheels 10 from which the wheel data set 50 is transmitted. That is, the identification data 54 serves to confirm that the wheel identified by the same data 54 is one of the wheels of the vehicle in question rather than of another vehicle. The check sum data 60 is provided

for effecting a parity check or for otherwise checking an actual total volume of the wheel data set 50 transmitted from the transmitter. While a wheel state data is provided by the air pressure data 56 in the present embodiment of the invention, the state data may be provided by, in addition to the air pressure data 56, other data elements such as a tire temperature data representative of a temperature of the tire, an applied-force data representative of a force applied to the wheel in a transversal, longitudinal or vertical direction of the vehicle, a shape data representative of a shape of the tire, and a local-unit state data representative of a state of the local unit 20 such as a residual amount of electric energy left in a battery used in the local unit 20. The air pressure of the tire is detected by the air-pressure sensor 30 at predetermined time intervals, so that the wheel information generator 36 generates the wheel data set 50 which contains the air pressure data 56 representative of the detected air pressure and the identification data 54 stored in the memory 37. The generated wheel data set 50 is transmitted from the transmitting antenna 34 to the central unit 24.

[0027] The central unit 24 provided in the vehicle body 22 includes a receiving antenna 70 for receiving the wheel data sets 50 transmitted from the respective local units 20, a warning device 73, and a receiving controller 72 constituted principally by a computer including a central memory 74 and input and output portions. To the input and output portions of the receiving controller 72, there are connected the receiving antenna 70 and the warning device 73, so that the receiving controller 72

processes the wheel data sets received by the receiving antenna 70. The memory 74, which is provided by a non-volatile data storage, stores the identification data of each wheel data set and also various control programs such as a program for executing a data-reception routine which is illustrated by the flow chart of Fig. 4. The receiving controller 72 further includes a communication-intensity changing or reducing device in the form of a sensitivity adjustor 76 for adjusting a reception sensitivity of the central unit 24. In the receiving controller 72, signals supplied from the receiving antenna 70 are subjected to predetermined processing operations such as filtering and amplification, and each of the signals is adapted to have an intermediate frequency. Then, each signal is converted into a digital signal, after a level of each signal has been compared with a reference (threshold) level in a comparator. In the present embodiment, a voltage level of each signal received by the receiving antenna 70 is detected, so that the signal is not processed if the detected voltage level is lower than a target voltage level. That is, the reception sensitivity of the receiver 78 is made lower when the target voltage level is relatively high, than when the target voltage level is relatively low. The actual voltage level of each signal received by the receiving antenna 70 is detected at terminals of IC provided for the intermediate frequency processing, and the detected voltage level is compared with the target voltage level in the comparator.

[0028] In the present embodiment, the sensitivity adjustor 76 is constituted by the terminals, comparator and means for changing the target voltage level. The receiving antenna 70 and

the receiving controller 72 constitute a receiver 78. The receiving controller 72 constitutes a vehicle wheel information processing apparatus. It is also possible to consider that the receiver 78 is constituted by the receiving antenna 70 and a portion of the receiving controller 72 which relates to the reception of the wheel data sets 50, and that the vehicle wheel information processing apparatus is constituted by a portion of the receiving controller 72 which is assigned to process the wheel data sets 50.

[0029] The receiving controller 72 is selectively placed in an identification-data registering mode and an air-pressure data obtaining mode. When the receiving controller 72 is in the identification-data registering mode, a content of the identification data 54 contained in each wheel data set 50 is stored in the memory 74 of the central unit 24. This identification-data registering mode is selected, for example, when a new wheel or wheels are mounted on the axle or axles of the vehicle in a factory of vehicle production, or when one of the wheels is replaced with another wheel in a repair shop. When the receiving controller 72 is in the air-pressure data obtaining mode, a content of the air pressure data 56 contained in each wheel data set 50 is read by the receiving controller 72. The detected value of the air pressure represented by the air pressure data 56 is compared with a predetermined minimum value, so that the warning device 73 is activated if the detected value is lower than the predetermined minimum value. In this instance, it is determined whether the content of the identification data 54 of each wheel data 50 received by the receiving antenna 50 coincides

with the content of the identification data which has been stored in the memory 74. If the currently received content of the identification data 54 coincides with the stored content of the identification data 54, it is determined that the wheel data set 50 is determined to have been transmitted from one of the wheels of the subject vehicle, whereby the wheel data set 50 is proceed as described above. If the currently received contend of the identification data 54 does not coincide with the stored content of the identification data 54, the wheel data set 50 is not processed.

[0030] In the present embodiment, the reception sensitivity of the receiver 78 is reduced to be lower when the identification-data registering mode is being established, than when the air-pressure data obtaining mode is being established. Owing such an adjustment of the reception sensitivity of the receiver 78, the receiver 78 receives the wheel data sets 50 transmitted from the wheels 10 of the vehicle in question but does not receive wheel data sets transmitted from the wheels of another vehicle, i.e., a vehicle positioned close to the vehicle in question.

[0031] With the identification-data registering mode being established, the reception sensitivity of the receiver 78 is reduced to a minimum level required to enable the receiver 78 to receive the wheel data sets 50 when the vehicle stays inside a building (e.g., a factory building) with the wheels 10 being not rotated or rotated at a speed not higher than a predetermined value (namely, with the wheels 10 being held substantially stationary). When the vehicle stays inside a building (rather than on an ordinary road)

with the wheels 10 being held substantially stationary (rather than being rotated), the receiver 78 does not receive a large noise or other large disturbance which would interfere or affect the function of the receiver 78. In this instance, the level of a small noise received by the receiver 78 can be previously estimated, for example, in view of a construction of the receiver 78, while an output strength of the transmitting antenna 34 is a known value. Therefore, the above-described minimum level of the reception sensitivity of the receiver 78 can be determined principally based on the environment and the construction of the receiver 78.

[0032] After the registration of the identification data has been completed, the reception sensitivity of the receiver 78 is increased by the sensitivity adjustor 76, whereby the wheel data sets 50 can be reliably received by the receiver 78 when the vehicle is running on a road, namely, when the receiver 78 is subjected to a large disturbance. It is noted that the receiver 78 may be adjustable by the sensitivity adjustor 76, such that the reception sensitivity of the receiver 78 is adjustable to a selected one of two levels (i.e., a relatively high level and a relatively low level), or alternatively, such that the reception sensitivity of the receiver 78 is continuously variable.

[0033] The switching of the receiving controller 72 from the air-pressure data obtaining mode to the identification-data registering mode may be effected in response to a switch requesting signal transmitted from a device that is connected with the central unit 24, or alternatively, may be effected in response to a switch requesting signal that is transmitted from

one of the local units 20 when the change rate of the air pressure of the corresponding tire is equal to or higher than a predetermined value. In either of these two arrangements, the switching is effected in response to the switch requesting signal (trigger signal) supplied to the central unit 24.

[0034] The data-reception routine, which is illustrated by the flow chart of Fig. 4, is initiated with step S1 to determine whether the switch requesting signal (trigger signal) has been detected or received by the central unit 24. If an affirmative decision is obtained in step S1, step S2 is implemented to switch the receiving controller 72 from the air-pressure data obtaining mode to the identification-data registering mode. Step S2 is followed by step S3 in which the reception sensitivity of the receiver 78 is reduced by the sensitivity adjustor 76. With the reception sensitivity being held in the relatively low level, the transmission of the wheel data set 50 from the transmitter 38 of each local unit 20 (which is effected constantly at a predetermined time interval) is awaited by the receiver 78 of the central unit 24. Thus, the receiving antenna 70 of the receiver 78 receives the wheel data sets 50 transmitted from the respective transmitters 38 of the local units 20. Steps S4 and S5 are implemented to determine whether a number of the received wheel data sets 50 has reached a predetermined number, i.e., a number of the tires mounted on the vehicle. If the number of the received wheel data sets 50 has reached the predetermined number, step S6 is implemented whereby the identification data 54 contained in each of the wheel data sets 50 is stored in the central memory 74.

Thereafter, step S7 is implemented whereby the reception sensitivity of the receiver 78 is increased so that the identification-data registering mode is changed back to the air-pressure data obtaining mode.

[0035] As is apparent from the above description, the vehicle wheel information obtaining apparatus constructed according to the present embodiment in which the reception sensitivity of the receiver 78 is reduced, the identification data actually transmitted from another vehicle is prevented from being erroneously registered as if it were the identification data transmitted from the subject vehicle, even where the other vehicle is positioned close to the subject vehicle. Further, the present apparatus does not require a large length of time for correctly registering the identification data, unlike the above-described conventional apparatus. The erroneous registration (in which the identification data transmitted from the other vehicle is registered) might be prevented by an arrangement in which a format of the wheel data set is variable depending upon whether the receiving controller 72 is currently placed in the identification-data registering mode or the air-pressure data obtaining mode. However, in the present apparatus, the erroneous registration can be reliably avoided, even without such an arrangement, namely, even if the transmitter is not capable of varying the format of the wheel data set.

[0036] While the reception sensitivity of the receiver 78 is reduced in the apparatus of the present embodiment, the transmission strength of the transmitter 38 may be reduced in

addition to or in place of the reduction of the reception sensitivity of the receiver 78. In a vehicle production line in which a large number of vehicles are produced, there is a case where wheels are simultaneously mounted on axles of a plurality of vehicles, whereby the identification-data registrations are effected simultaneously in the plurality of vehicles. Even in such a case, there is no risk that the receiver provided in the body of each vehicle receives the wheel data set transmitted from the other vehicle, if the transmission strengths of the transmitters of all the vehicles are reduced. Further, the content of the identification data transmitted from each wheel does not have to be stored directly into the memory 74. For example, where the content (number) of the identification data is constituted by two or more binary digits, a number to be stored may be a radix complement or a radix-minus-one complement of the content (number).

[0037] The principle of the present invention is equally applicable to a vehicle wheel information obtaining apparatus having a provision for registering the identification data depending upon the frequency of the reception of the identification data, or a vehicle wheel information obtaining apparatus having a provision for varying a format of the wheel data set depending upon whether the receiving controller is currently placed in the identification-data registering mode or the air-pressure data obtaining mode. In either of these cases, the identification data transmitted from each wheel of the subject vehicle is more reliably registered. It is to be understand that the present invention may be embodied with various other changes,

modifications and improvements, such as those described in the SUMMARY OF THE INVENTION, which may occur to those skilled in the art, without departing from the spirit and scope of the invention defined in the following claims:

WHAT IS CLAIMED IS:

1. A vehicle wheel information obtaining apparatus for obtaining wheel information relating to a wheel of a vehicle, said apparatus comprising:

a wheel state detector which is provided on the wheel and which detects a state of the wheel;

a transmitter which is provided on the wheel and which transmits a wheel data set, as said wheel information, containing a wheel state data representing the detected state of the wheel and a wheel identification data identifying the wheel;

a receiver which is provided on a body of the vehicle and which receives said wheel data set transmitted by said transmitter;

a data processor which processes said wheel data set received by said receiver, said data processor having an identification-data registering mode for registering said wheel identification data contained in said wheel data set, and a wheel-state data obtaining mode for obtaining said wheel state data contained in said wheel data set; and

a communication-intensity reducing device which reduces at least one of a transmission strength of said transmitter and a reception sensitivity of said receiver, such that said at least one of said transmission strength and said reception sensitivity is lower when said data processor is in said identification-data registering mode, than when said data processor is in said wheel-state data obtaining mode.

2. A vehicle wheel information obtaining apparatus according to claim 1, wherein said communication-intensity reducing device reduces said reception sensitivity of said receiver, such that said reception sensitivity is lower when said data processor is in said identification-data registering mode, than when said data processor is in said wheel-state data obtaining mode.

3. A vehicle wheel information obtaining apparatus according to claim 1, further comprising:

a communication-intensity increasing device which is operable when registration of said wheel identification data is completed, to increase said at least one of said transmission strength and said reception sensitivity that has been reduced by said communication-intensity reducing device.

4. A vehicle wheel information obtaining apparatus according to claim 1,

wherein each of at least one of said transmitter and said receiver is placed in a selected one of a plurality of different operation modes,

and wherein said plurality of different operating modes include a relatively high intensity mode in which at least one of said transmission strength and said reception sensitivity is relatively high, and a relatively low intensity mode in which at least one of said transmission strength and said reception

sensitivity is relatively low.

5. A vehicle wheel information obtaining apparatus according to claim 1, wherein said communication-intensity reducing device reduces each of said at least one of said transmission strength and said reception sensitivity, to a minimum level required to enable said wheel data set to be received by said receiver when a rotational speed of the wheel is not higher than a predetermined value.

6. A vehicle wheel information obtaining apparatus according to claim 1, wherein said communication-intensity reducing device reduces each of said at least one of said transmission strength and said reception sensitivity, to a minimum level required to enable said wheel data set to be received by said receiver when said receiver does not receive a noise whose level is higher than a predetermined value.

7. A vehicle wheel information obtaining apparatus according to claim 1, wherein said communication-intensity reducing device reduces each of said at least one of said transmission strength and said reception sensitivity, to a level that enables said receiver to receive said wheel data set transmitted from the wheel of the vehicle and that disables said receiver to receive a wheel data set transmitted from a wheel of another vehicle.

8. A vehicle wheel information obtaining apparatus for obtaining wheel information relating to a wheel of a vehicle, said apparatus comprising:

a wheel state detector which is provided on the wheel and which detects a state of the wheel;

a transmitter which is provided on the wheel and which transmits a wheel data set, as said wheel information, containing a wheel state data representing the detected state of the wheel and a wheel identification data identifying the wheel;

a receiver which is provided on a body of the vehicle and which receives said wheel data set transmitted by said transmitter;

a data processor which processes said wheel data set received by said receiver, said data processor having an identification-data registering mode for registering said wheel identification data contained in said wheel data set, and a wheel-state data obtaining mode for obtaining said wheel state data contained in said wheel data set; and

a communication-intensity changing device which changes at least one of a transmission strength of said transmitter and a reception sensitivity of said receiver, such that said at least one of said transmission strength and said reception sensitivity varies depending upon whether said data processor is in said identification-data registering mode or in said wheel-state data obtaining mode.

9. A vehicle wheel information processing

apparatus for processing wheel information relating to a wheel of a vehicle, said apparatus comprising:

a receiver which is provided on a body of the vehicle and which receives a wheel data set, as said wheel information, containing a wheel state data representing a state of the wheel and a wheel identification data identifying the wheel;

a data processor which processes said wheel data set received by said receiver, said data processor having an identification-data registering mode for registering said wheel identification data contained in said wheel data set, and a wheel-state data obtaining mode for obtaining said wheel state data contained in said wheel data set; and

a reception-sensitivity reducing device which reduces a reception sensitivity of said receiver, such that said reception sensitivity is lower when said data processor is in said identification-data registering mode, than when said data processor is in said wheel-state data obtaining mode.

10. A vehicle wheel information processing apparatus for processing wheel information relating to a wheel of a vehicle, said apparatus comprising:

a receiver which is provided on a body of the vehicle and which receives a wheel data set, as said wheel information, containing a wheel state data representing a state of the wheel and a wheel identification data identifying the wheel;

a data processor which processes said wheel data set received by said receiver; and

a reception-sensitivity reducing device which reduces a reception sensitivity of said receiver, such that said reception sensitivity is lower when a rotational speed of the wheel is not higher than a predetermined value, than when the rotational speed of the wheel is higher than the predetermined value.

ABSTRACT OF THE DISCLOSURE

A vehicle wheel information obtaining apparatus for obtaining wheel information relating to a wheel of a vehicle. The apparatus includes: (a) a wheel state detector which detects a state of the wheel; (b) a transmitter which is provided on the wheel and which transmits a wheel data set containing a wheel state data representing the detected state of the wheel and a wheel identification data identifying the wheel; (c) a receiver which is provided on a vehicle body and which receives the wheel data set transmitted by the transmitter; (d) a data processor which processes the wheel data set received by the receiver; and (e) a communication-intensity reducing device which reduces a transmission strength of the transmitter or/and a reception sensitivity of the receiver, such that the transmission strength or/and the reception sensitivity is lower when the data processor is in an identification-data registering mode, than when the data processor is in a wheel-state data obtaining mode.

FIG. 1

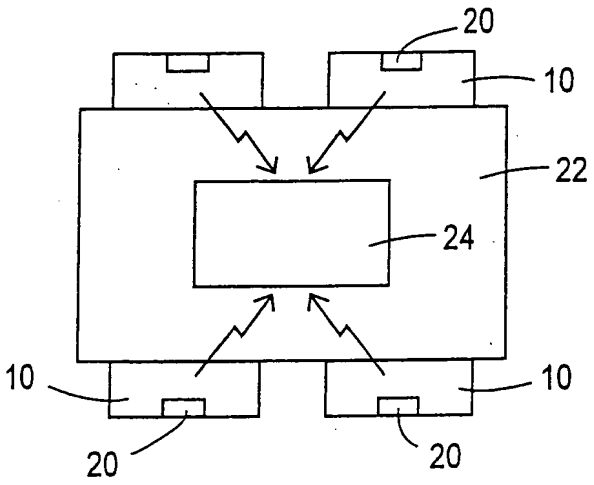
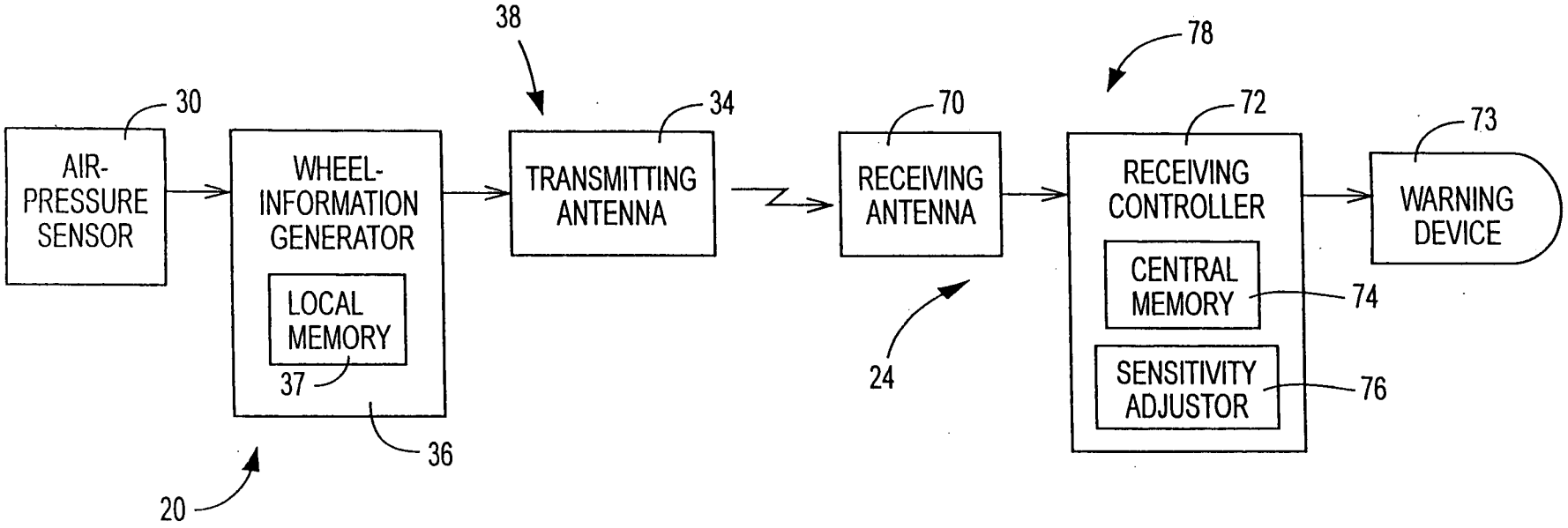


FIG. 2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78
30
34
70
72
73
AIR-
PRESSURE
SENSOR
WHEEL-
INFORMATION
GENERATOR
LOCAL
MEMORY
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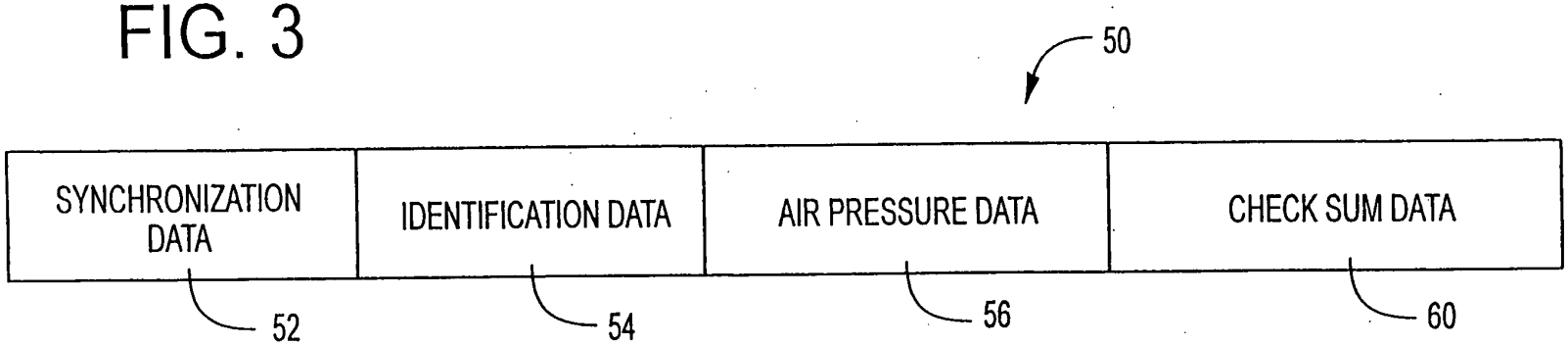
36
TRANSMITTING
ANTENNA
RECEIVING
ANTENNA
24
RECEIVING
CONTROLLER
CENTRAL
MEMORY
74
SENSITIVITY
ADJUSTOR
76
WARNING
DEVICE
20

FIG. 3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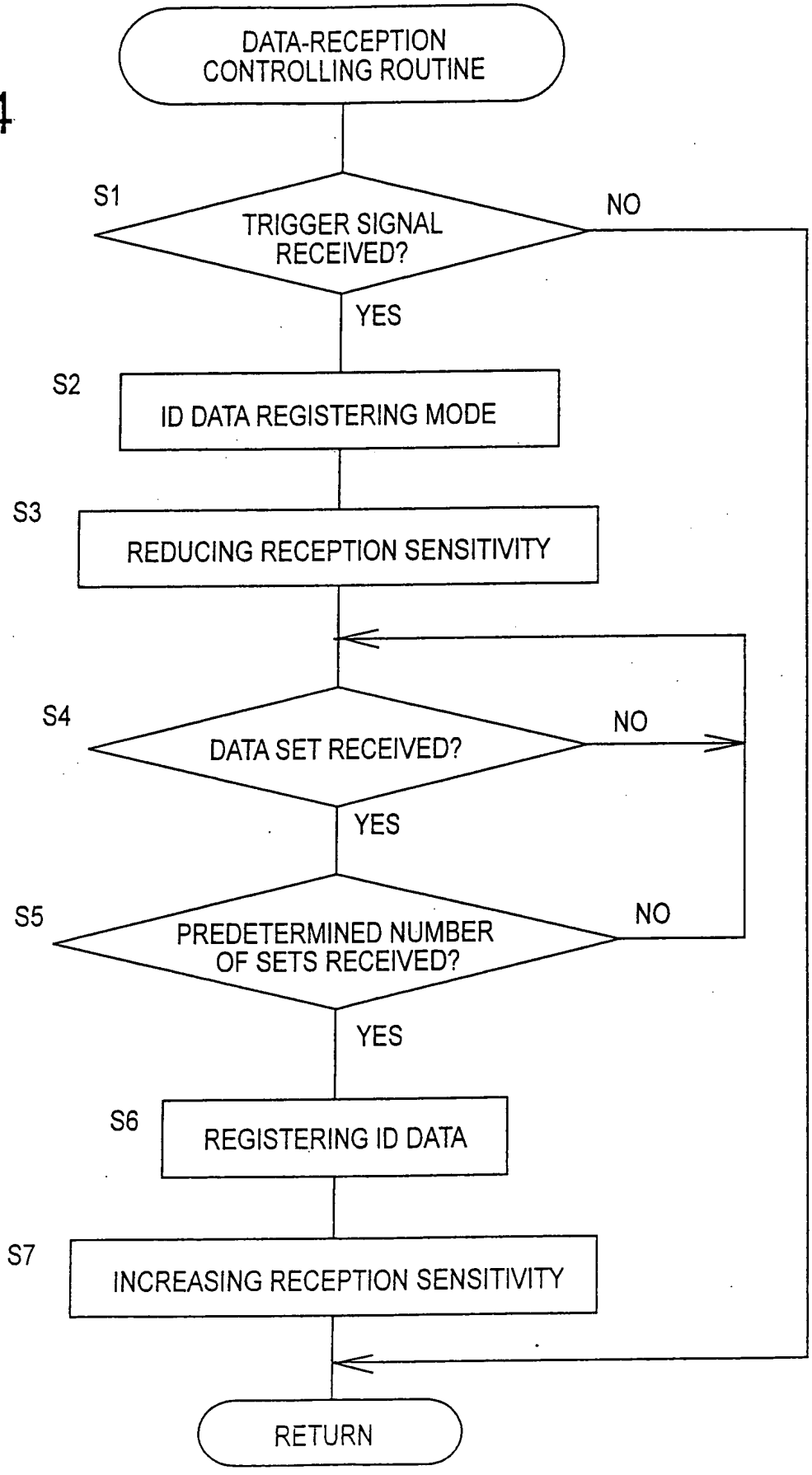
SYNCHRONIZATION
DATA
IDENTIFICATION DATA
AIR PRESSURE DATA
CHECK SUM DATA
52
54
56
60

FIG. 4


DATA-RECEPTION CONTROLLING ROUTINE
S1
TRIGGER SIGNAL RECEIVED?
NO
YES
S2
ID DATA REGISTERING MODE
S3
REDUCING RECEPTION SENSITIVITY
S4
DATA SET RECEIVED?
NO
YES
S5
PREDETERMINED NUMBER OF SETS RECEIVED?
NO
YES
S6
REGISTERING ID DATA
S7
INCREASING RECEPTION SENSITIVITY
RETURN